

Loss Prevention Standard

LPS® 1656 : Issue 1.0

Requirements and test methods for the LPCB approval of Condensed Aerosol Extinguishing Generators

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DEVELOPMENT OF LOSS PREVENTION STANDARDS

This standard was developed with input from technical experts from the fire protection industry and by wider consultation and comment through the publication, on the BRE Global website, of a draft for public comment. All feedback and comments received have been considered and, where appropriate, incorporated into this document.

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REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards (LPS®s) will be revised by issue of revised editions or amendments. Details will be posted on our website at www.RedBookLive.com.

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

Users of LPS®s should ensure that they possess the latest issue and all amendments.

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FOREWORD

This Standard identifies the evaluation and testing practices required for the approval and listing of products and services. LPCB listing and approval of products and services is based on evidence acceptable to LPCB:-

- that the product or service meets the standard;
- that the manufacturer or service provider has staff, processes and systems in place to ensure that the product or service delivered meets the standard

and on:-

- periodic audits of the manufacturer or service provider including testing as appropriate;
- compliance with the contract for LPCB listing and approval including agreement to rectify faults as appropriate;

The responsibility for ensuring compliance with the technical and managerial process and requirements for the product or service lies with the manufacturer, service provider or supplier.

This standard is based on the requirements of the relevant parts of BS EN 15276-1¹: *“Fixed firefighting systems: Condensed aerosol extinguishing systems – Part 1: Requirements and test methods for components”*. And BS EN 15276-2²: *“Fixed firefighting systems: Condensed aerosol extinguishing systems – Part 2: Design, Installation and Maintenance.”*

It should be read in conjunction with these documents and Scheme Document SD 228 “LPCB approval of fire suppression products”.

NOTES

Compliance with this LPS® does not of itself confer immunity from legal obligations. Users of LPS®s should ensure that they possess the latest issue and all amendments.

LPCB welcomes comments of a technical or editorial nature and these should be addressed to “the Technical Director” at BRE Global.

The BRE Trust, a registered charity, owns BRE and BRE Global. BRE Global and LPCB (part of BRE Global) test, assess, certificate and list products and services within the fire

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and security sectors. For further information on our services please contact BRE Global, Watford, Herts. WD25 9XX or e-mail to enquiries@bregroup.com.

Listed products and services appear in the LPCB “List of Approved Products and Services” which may be viewed on our website: www.redbooklive.com, App Store (for iPhone and iPad), from Google Play (for Android devices) or from the Windows Store (for Windows 8 Phones).

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1 SCOPE AND LIMITATIONS

1.1 Scope

This standard specifies requirements and testing procedures for the LPCB certification and listing of fixed condensed aerosol extinguishing generators.

These generators comprise a non-pressurized container filled with a dry solid fire extinguishing compound which, when activated, discharges an aerosol to extinguish the fire.

Generators are typically activated by appropriate fire detectors with the aim of ensuring that they operate early in the fire development phase. Detection methods and design philosophy fall outside the scope of this standard.

Fixed condensed aerosol generators typically consist of the following components:

- a) Solid aerosol-forming compound
- b) Cooling mechanism
- c) Actuation device
- d) Discharge outlet/s
- e) Housing
- f) Mounting bracket

This combination of components is known as an aerosol generator.

This standard covers generators designed to be fixed in place for “total flooding” applications, where the whole protected risk area is filled to achieve a specific design application density.

Subject to satisfactory performance against the requirements of this standard, including full scale fire tests, these generators can be designated for use against the following classes:

- Class A (solid surface burning fires)
- Class B (liquid pool fires)
- Grouped power or data cable fires

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1.2 Limitations of use

This standard does not cover generators for “local application” uses.

This standard covers generators for fixed commercial land-based applications only.

This standard does not cover the design, installation and maintenance of condensed aerosol extinguishing systems. BS EN 15276 parts 1 and 2, contain guidance on the use, limitations, safety considerations and precautions, venting, structural strength, detection, actuation and control arrangements as well as commissioning, acceptance and maintenance procedures.

Aerosol system generators are approved on the basis that they will be installed and maintained in accordance with BS EN 15276 and the manufacturer’s instructions.

Whilst the design and application of systems falls outside the scope of this standard it should be noted that, the effective extinguishing capacity of condensed aerosol generators is dependent on early detection and activation. This is particularly relevant to class A risks where activation early in the fire development phase can prevent a fire from becoming “deep seated”.

Reduced visibility during and after discharge together with potential toxicity restricts the use of a condensed aerosol total flooding system to normally unoccupied and un-occupiable areas only. In any proposed use of condensed aerosol where there is a possibility that people can enter the protected enclosure or be close to the protected risk, suitable safeguards such as personnel training, warning signs, pre-discharge alarms, system isolation and emergency hold switches shall be provided.

Determination for use of a condensed aerosol agent in spaces that are normally occupied, normally unoccupied or un-occupiable should be based on an evaluation of the adverse effect(s) caused due to accidental exposure to the agent. Potential adverse health effects should be assessed for the particulate concentration, the size of the particulates and the concentration of gases expected after actuation of the aerosol generator at the design application density.

Exposure to a condensed aerosol agent should be avoided.

The potential adverse effects of aerosol extinguishing agent discharge residue on sensitive equipment and other objects should also be considered as part of the design and application of the system.

The limitations of use stated in BS EN 15276 are also applicable to this standard.

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Condensed aerosol extinguishers should not be used for the following fire hazards unless relevant testing by accredited testing laboratories has been carried out:

- Deep seated fires in Class A materials
- Chemicals containing their own oxygen supply, such as cellulose nitrate
- Mixtures containing oxidising materials, such as sodium chlorate or sodium nitrate
- Chemicals capable of undergoing auto-thermal decomposition, such as some organic peroxides
- Reactive metals (such as sodium, potassium, magnesium, titanium and zirconium), reactive hydrides, or metal amides, some of which may react violently with some aerosol extinguishants
- Oxidising agents such as nitric oxide and fluorine
- Pyrophoric materials such as white phosphorous or metallo-organic compounds.

The above list may not be exhaustive.

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2 DEFINITIONS

2.1 activator/activation device

device which is intended to ignite the solid aerosol forming compound

2.2 aerosol generator

non-pressurised container which, when activated, generates a condensed aerosol extinguishing agent

2.3 design application density

extinguishing density of an extinguishant, multiplied by the safety factor, required for system design purposes measured in g/m^3

2.4 discharge time

time from generator activation until the end of aerosol discharge

2.5 efficiency

efficiency is the assessment of the effective mass of discharged extinguishant for each generator type expressed as a percentage of the mass of aerosol compound before activation

2.6 extinguishing density

effective minimum mass of discharged extinguishant per unit of enclosure volume required to extinguish fire involving a specific fuel under defined experimental conditions, using a specific aerosol generator type and size, excluding any safety factor measured in g/m^3

2.7 solid aerosol forming compound

mixture of oxidant, combustible component and technical admixtures producing fire extinguishing aerosol upon activation

2.8 system manual

document containing design, installation and maintenance rules for all details of a condensed aerosol extinguishing generator

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3 REQUIREMENTS

3.1 Documentation

3.1.1 Documents required: Prior to examination and testing of the condensed aerosol extinguishing generator, an applicant shall provide LPCB with comprehensive information about the generator and its components and materials. All documents shall be dated and given a reference number, issue and title.

These documents shall include:

- Production Drawings (including materials and finish)
- Document Register (containing date, issue and status of all documents)
- Full material specification of components, manufacturer and designation
- Details of jointing compounds/materials/tools and procedures (including manufacturers of tools, materials and compounds)
- System manual and operating instructions
- Safety data sheet/s
- Installation instruction including mounting instructions
- Maintenance requirements
- Full user documentation
- Details of any training which may be available or required

Documents shall be sufficient so that LPCB can carry out a full review of the design of the generator.

If the applicant is not the manufacturer i.e. is a supplier, then an application must be accompanied by written permission for testing and approval from the manufacturer(s).

3.2 Safety

3.2.1 The aerosol generator and the solid aerosol forming compound shall be safe to people and the environment during processing, storage and in service.

3.2.2 The aerosol generator and the solid aerosol forming compound shall meet the requirements and guidance of the relevant clauses of BS EN 15276.

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3.3 Testing

3.3.1 Test apparatus

Except where stated, test apparatus shall be in accordance with the relevant parts of BS EN 15276.

3.3.2 Environmental conditions

Except where stated, environmental conditions shall be in accordance with the relevant parts of BS EN 15276.

3.3.3 Test methods and procedures

Except where stated, test methods and procedures shall be in accordance with the relevant parts of BS EN 15276.

3.3.4 Results and data analysis

Except where stated, the results and data analysis shall be in accordance with the relevant parts of BS EN 15276.

3.4 Chemical composition of the aerosol forming compound

The chemical composition shall be provided by the manufacturer or supplier and shall be confidentially recorded. The manufacturer or supplier shall have processes in place that provide evidence that the compound is unchanged from that tested. This will be verified prior to certification and at periodic intervals thereafter.

3.5 Application densities

3.5.1 Procedures for determining the minimum design application density for a particular fire are contained in BS EN 15276 -2, paragraph 6.4.

3.5.2 Class B fires

3.5.2.1 Extinguishing density

The minimum extinguishing densities for class B fires are described in BS EN 15276 -2, paragraph 6.4.1.

Test methods and methods for determining performance in this respect are described in BS EN 15276 - 1 annex A.

For each test the fuel is ignited and allowed to burn for 30 seconds before the extinguishing generator/s are activated.

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Three successful demonstrations of satisfactory extinguishment are required.

Aerosol generators shall meet these requirements.

3.5.2.2 Design application density

The minimum design application density for class B fires shall be the highest extinguishing density derived from the n-heptane pan test (EN 15276-1 A 6.2) and the generator distribution tests (EN 15276-1 A 5.1 and 5.2) multiplied by a 1.3 safety factor.

3.5.3 Class A surface burning fires

3.5.3.1 Extinguishing density

The minimum extinguishing density for class A surface burning fires are described in BS EN 15276 - 2, paragraph 6.4.

Test methods and methods for determining performance in this respect are described in BS EN 15276 - 1 annex A.

Test EN 15276-1 A 6.1 details the “wood crib” fire test procedures using a single wood crib consisting of four layers of six 40mm x 40mm lumber, with a pre-burn time of 120 seconds.

Test EN 15276-1 A 6.3 details fire test procedures for three polymeric fuels, Polymethyl methacrylate (PMMA), Polypropylene (PP) and Acrylonitrile-butadiene-styrene polymer (ABS), with a pre-burn time of 210 seconds.

Test EN 15276-1 A 6.4 details the “compatible wood crib” fire test procedures using two wood cribs consisting of eight layers of four 38mm x 38mm lumber, with a pre-burn time of 120 seconds.

In each case three successful demonstrations of satisfactory extinguishment are required.

Aerosol generators shall meet these requirements.

3.5.3.2 Design application density

The minimum design application density for class A surface fires shall be the highest extinguishing density derived from fire tests EN 15276-1 A 6.1, A 6.3 and A 6.4, The result should be multiplied by a 1.3 safety factor.

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3.5.4 Grouped power or data cable fires (optional with requirement)

It is recognized that certain plastic fuel hazards (e.g. electrical and electronic type hazards involving grouped power or data cables such as computer and control room under-floor voids and telecommunications facilities) present particular challenges for extinguishment.

Appendix A provides details of the Class A grouped cable fire test comprising of 6 cable tray layers.

The fire test requirements for grouped power or data cable fires are:

- a) The fire test shall be extinguished (no flaming) within 180 seconds of the start of agent discharge at the first attempt;
- b) There shall be no re-ignition of the fire for a period of ten minutes after the end of agent discharge;
- c) Significant deviation of design parameters observed during the test shall be reported and investigated;

3.5.4.1 Extinguishing density

The extinguishing density for grouped power or data cable fires is that which achieves satisfactory extinguishment of the Class A grouped cable fire over three successive tests.

3.5.4.2 Design application density

The minimum design application density for grouped power or data cable fires shall be the highest extinguishing application density from the Class A fire tests. The result should be multiplied by a 1.3 safety factor.

3.6 Performance requirements

3.6.1 Aerosol distribution coverage

The performance requirements for maximum area coverage and the maximum and minimum protected area height limitations for each aerosol generator unit size are described in BS EN 15276 - 1, paragraphs 5.3 and 7.5.

Test methods and methods for determining performance in this respect are described in BS EN 15276 - 1 annex A paragraphs A 5.1 & A 5.2.

Aerosol generators shall meet these requirements.

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3.6.2 Functional reliability

3.6.2.1 Tolerances

The following tolerances apply to all of the function tests

Parameter	Requirement	Tolerance
Visual observation	During discharge: no flaming from generator	Nil
Discharge time	As specified by manufacturer.	± 5 seconds or 20% (whichever is greater)
	Maximum 90 seconds.	Nil
Casing temperature	As specified by manufacturer up to 400°C	400°C (surface) is a maximum
Aerosol flow temperatures for 75°C, 200°C and 400°C at the minimum clearances	As specified by manufacturer (distance in mm)	Nil (These are minimum safe distances)

3.6.2.2 Discharge time and characteristics

The performance requirements for discharge time for aerosol generators are described in BS EN 15276 - 1, paragraph 5.4 and 7.14.1.

Discharge time shall be specified by the manufacturer and shall not exceed 90 s.

Discharge shall be continuous from activation of the generator until the end of aerosol discharge.

Aerosol generators shall meet the requirements of BS EN 15276 - 1 paragraph 17.4.1.

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3.6.2.3 Maximum casing temperature

The manufacturer shall specify the maximum developed casing temperature.

During and after discharge the casing temperature, measured by attaching a thermocouple to the surface of the casing, shall not exceed 400°C.

Aerosol generators shall meet these requirements.

3.6.2.4 Minimum thermal clearances

The performance requirements for minimum thermal clearance for aerosol flow temperatures are described in BS EN 15276 1, paragraphs 5.11.3 and 7.14.2.

Minimum thermal clearances from each type of aerosol generator's discharge outlet(s) for 75°C (personnel), 200°C (combustible materials) and 400°C (non-combustible materials) shall be specified in the system manual.

Aerosol generators shall meet the requirements of BS EN 15276 -1 paragraph 7.14.

3.6.2.5 Efficiency of generator

The method for assessing the efficiency (i.e. effective mass of extinguishant) of each type of aerosol generator is as follows:

- a) Condition the generator for 16 hours at ambient temperature of (21 ± 4) °C.
- b) Note the mass of compound in the generator according to the manufacturer's specification (Mc).
- c) Record the total mass of the generator before discharge (Mb).
- d) Subject the generator to a discharge function test.
- e) Record the total mass of the generator after discharge (Ma).
- f) Calculate the efficiency of the generator using the formula:

$$\frac{Mb - Ma}{Mc} \times 100 = \text{Efficiency}$$

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3.6.3 Service life

The minimum service life period shall be 15 years.

The service life period includes the storage and installation life of the aerosol generators and shall be specified in the system's manual.

The specified service life shall be verified by test using the accelerated ageing test in 3.6.3.1

3.6.3.1 Accelerated ageing

Aerosol generators and their mounting brackets shall meet the requirements of BS EN 15276 - 1 paragraph 7.7.

3.6.3.2 Low temperature test

Aerosol generators shall meet the requirements of BS EN 15276 - 1 paragraph 7.6.3.

3.6.3.3 Ambient temperature and humidity operation range

The performance requirements for ambient temperature and humidity operation range for aerosol generators are described in BS EN 15276 - 1, paragraph 5.5.

Aerosol generators shall be designed to be operable for the total service life period within the temperature and humidity range specified in the system's manual.

Aerosol generators and any mounting brackets shall meet the requirements of BS EN 15276 - 1 paragraph 7.6.1 and 7.6.2.

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3.6.4 Vibration resistance

The performance requirements for vibration resistance for aerosol generators are described in BS EN 15276 - 1, paragraph 5.9.

Aerosol generators and associated ancillaries including any mounting brackets shall meet the requirements of BS EN 15276 - 1 paragraph 7.10.

3.6.5 Corrosion resistance

The performance requirements for corrosion resistance for aerosol generators are described in EN15276 - 1, paragraph 5.8.

Aerosol generators and associated ancillaries including any mounting brackets shall meet the requirements of BS EN 15276 - 1 paragraphs 7.8 and 7.9.

3.6.6 Impact resistance

The performance requirements for impact resistance for aerosol generators are described in BS EN 15276 - 1, paragraph 5.10.

Aerosol generators shall meet the requirements of BS EN15276 - 1 paragraph 7.11.

3.6.7 Exposure to fire

Aerosol generators intended for installation inside the protected enclosure shall be tested for reliability of operation and effectiveness of the discharge under heat exposure conditions.

Aerosol generators shall meet the requirements of BS EN 15276 - 1 paragraph 7.15.

3.6.8 Potentially explosive atmospheres (optional with requirement)

Where generators are to be used in potentially explosive atmospheres the compatibility of the generator to this environment should be assessed in accordance with ATEX directive 2014/34/EU.

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3.6.9 Mounting device strength test

Mounting devices shall withstand without damage or permanent distortion an applied static load equivalent to five times the weight of the aerosol generator.

Mounting device samples representative of each size and design of mounting device, shall be fixed to a wall or ceiling in accordance with the system manual. The static load shall then be applied for a period of 10 minutes.

At the end of the test the mounting bracket shall be examined for damage or permanent distortion.

3.7 Activation

3.7.1 System manual

The technical characteristics and activation processes shall be specified in the system manual.

3.7.2 Test methods

Activation devices for aerosol generators shall meet the requirements of BS EN 15276-1 paragraph 5.12 and 7.13.

All samples of the device shall operate as intended.

3.7.2.1 Electrical activators

The minimum activation current and, voltage range shall be specified in the system manual.

The bridge resistance of the activator/s shall be specified in the system manual. Prior to testing the bridge resistance of each activator shall fall within the specified range.

The power output of the activator shall not be less than that specified at the minimum activation current sufficient to ignite the maximum designed mass of aerosol forming compound at the highest and lowest service temperature specified by the manufacturer.

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A representative range of activators shall be tested at a range of activation currents representative of the minimum and maximum activation currents in service, after being conditioned as follows:

- a) Conditioned at ambient temperature ($21^{\circ} \pm 4$) °C for 24 hours and then activated.
- b) Conditioned at maximum service temperature for 24 hours and then activated.
- c) Conditioned at minimum service temperature for 24 hours and then activated.
- d) The maximum number of activators specified by the manufacturer for wiring in series shall be conditioned at ambient temperature ($21^{\circ} \pm 4$) °C for 24 hours and then activated.
- e) The maximum number of activators specified by the manufacturer for wiring in series, shall be conditioned at maximum service temperature for 24 hours and then activated.
- f) The maximum number of activators specified by the manufacturer for wiring in series, shall be conditioned at minimum service temperature for 24 hours and then activated.

Note: Activators are also tested throughout the generator function test programme, any failures shall be investigated.

3.7.2.2 Thermal actuators

The minimum rated temperature at which the device operates shall be specified in the system manual.

The thermal response and actuation mechanism should operate as stated in the manual.

4 MARKING, LABELLING AND PACKAGING

Each aerosol generator shall be marked in accordance with the relevant parts of BS EN 15276 - 1. The manufacturer or supplier shall provide appropriate marking, labelling and packaging for the safe transport and subsequent use of the components.

Rules and guidance on the use of LPCB certification marks are contained in PN 103.

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5 ADDITIONAL GUIDANCE DOCUMENTATION

PN103 “Rules and guidance on the use of LPCB certification marks”

PN111 “Factory production control”

6 PUBLICATIONS REFERRED TO:

1. BS EN 15276 – 1: *“Fixed firefighting systems - Condensed aerosol extinguishing systems – Part 1 Requirements and test methods for components”*
2. BS EN 15276 - 2: *“Fixed firefighting systems - Condensed aerosol extinguishing systems – Part 2 Design installation and maintenance”*
3. LPS 1230 *“Requirements for fire testing of fixed gaseous fire extinguishing systems.”*

For undated references please refer to the latest published issue.

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Appendix A:

Grouped cable Class A fire test:

1. Test Facility

Criteria for the test facility are described in LPS 1230³ “*Requirements for fire testing of fixed gaseous fire extinguishing systems.*”

Unless otherwise stated, the test facility, instrumentation and procedures shall be in accordance with this section.

2. Fuel package

The cable array consists of 6 cable tray layers, each with 10 cables on it as shown in Figure 1.

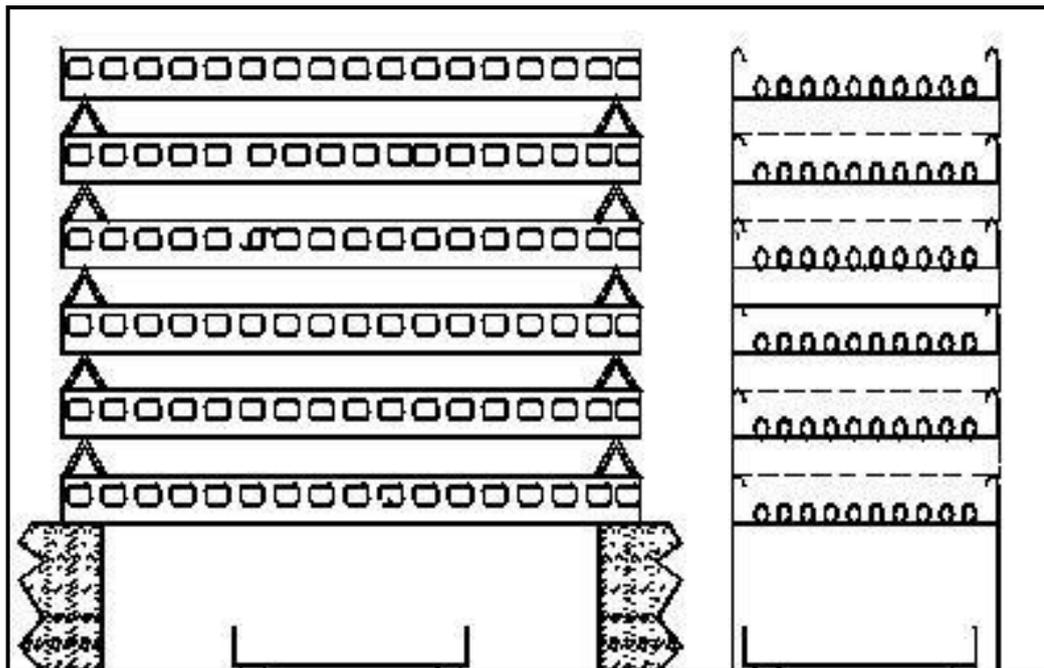


Figure 1: Grouped cable Class A fire test fuel configuration

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Test Parameter	Measurement
Cable	PVC "Ring main" cable – non fire retarded
Cable tray	length 750mm
Cable tray	width 230 mm
Cable	length 650mm
Number of cables per layer	10
Cable separation (distance between centres)	20 mm
Cable tray porosity	20.3%
Cable tray separation	20mm
Starter fuel (n-heptane) quantity	100ml
Height of fire above base of starter fuel	75mm

Table 1: Specification of the PVC cable tray fire

